

CLAIMS

1. ~~Composition intended to be formed into a material or an item which comprises:~~

- a semi-crystalline thermoplastic resin X_1 or
- 5 several compatible thermoplastic resins X_1 to X_n , at least one X_1 of which is semi-crystalline, and
- at least one block (sequential) copolymer,
- n being an integer equal to or greater than
- 1,

10 characterized in that:

- the block copolymer comprises at least three blocks A, B and C connected to one another in this order, each block being either a homopolymer or a copolymer obtained from two or more monomers, the A block being
- 15 connected to the B block and the B block to the C block by means of a covalent bond or of an intermediate molecule connected to one of these blocks via a covalent bond and to another block via another covalent bond, and in that:

- 20 - the A block is compatible with the thermoplastic resin or resins X_1 to X_n ,
- the B block is incompatible with the thermoplastic resin or resins X_1 to X_n and incompatible with the A block,
- 25 - the C block is incompatible with the thermoplastic resin or resins X_1 to X_n , the A block and the B block.

2. ~~Composition according to Claim 1, characterized in that the B block has a glass transition temperature~~
30 $T_{g(B)}$ of less than 23°C .

3. ~~Composition according to Claim 1 or 2, characterized in that the $T_{g(B)}$ of the B block is less than 0°C .~~

4. ~~Composition according to Claim 1 or 2, characterized in that the $T_{g(B)}$ of the B block is less than -50°C .~~

5. ~~Composition according to one of Claims 1 to 4, characterized in that the C block has a glass~~

A composition

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transition temperature $T_{g(C)}$ or a melting temperature $M.t.(C)$ which is greater than the $T_{g(B)}$ of the B block.

6. ~~Composition according to one of Claims 1 to 5, characterized in that the copolymer with at least three~~
5 A, B and C blocks comprises, as side products of its synthesis, a B-C diblock copolymer and optionally C homopolymer.

7. ~~Composition according to one of Claims 1 to 5, characterized in that the copolymer with at least three~~
10 A, B and C blocks comprises, as side products of its synthesis, an A-B diblock copolymer and optionally A homopolymer.

8. ~~Composition according to one of Claims 1 to 7, characterized in that the B block is chosen from~~
15 poly(dienes), in particular poly(butadiene), poly(isoprene) and their statistical copolymers, or alternatively from poly(dienes), in particular poly(butadiene), poly(isoprene) and their statistical copolymers, which are partially or completely
20 hydrogenated.

9. ~~Composition according to one of Claims 1 to 8, characterized in that the A block is connected to the B block via an oligomer resulting from a linkage of monomer units of at least two different monomers in an~~
25 alternating or random order.

10. ~~Composition according to one of Claims 1 to 9, characterized in that the B block is connected to the C block via an oligomer resulting from a linkage of monomer units of at least two different monomers in an~~
30 alternating or random order.

11. ~~Composition according to one of Claims 1 to 10, characterized in that it comprises:~~

35 - from 25 to 95%, advantageously from at least 50% and preferably from 65 to 95% by weight of the thermoplastic resin or resins X_1 to X_n ,

- the remainder (to 100%) by weight of the copolymer comprising the three A, B and C blocks connected to one another, these percentages being

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calculated with respect to the total weight of thermoplastic resin(s) with the block copolymer, and in that the block copolymer comprises:

- 20 to 93 parts by weight of A sequences
- 5 to 68 parts by weight of B sequences
- 2 to 65 parts by weight of C sequences.

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12. ^{aa} ~~Composition according to one of Claims 1 to 11, characterized in that it comprises, by weight:~~

- at least 50% and preferably from 65 to 95% of poly(carbonate), and
- the remainder to 100% of the PMMA-PB-PS triblock copolymer,

these percentages being calculated with respect to the total weight of thermoplastic resin(s) and of the block copolymer.

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13. ^{aa} ~~Composition according to one of Claims 1 to 11, characterized in that it comprises, by weight:~~

- at least 50% and preferably from 65 to 95% of poly(carbonate) PC, and

- the remainder to 100% of the poly(cyclohexyl methacrylate)-PB-PS triblock copolymer,

these percentages being calculated with respect to the total weight of thermoplastic resin(s) and of the block copolymer.

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14. ^{aa} ~~Composition according to one of Claims 1 to 11, characterized in that it comprises, by weight:~~

- at least 50% and preferably from 65 to 95% of poly(butylene terephthalate) PBT, and

- the remainder to 100% of the PMMA-PB-PS triblock copolymer,

these percentages being calculated with respect to the total weight of thermoplastic resin(s) and of the block copolymer.

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15. ^{aa} ~~Composition according to one of Claims 1 to 11, characterized in that it comprises, by weight:~~

- at least 50% and preferably from 65 to 95% of poly(oxyethylene) POE, and

the remainder to 100% of the PMMA-PB-PS triblock copolymer,

these percentages being calculated with respect to the total weight of thermoplastic resin(s) and of the block copolymer.

16. ^{aa} ~~Composition according to one of Claims 1 to 11, characterized in that~~ it comprises, by weight:

- at least 50% and preferably from 65 to 95% of poly(propylene) PP, and

the remainder to 100% of the poly(nonyl methacrylate)-PB-PS triblock copolymer,

these percentages being calculated with respect to the total weight of thermoplastic resin(s) and of the block copolymer.

17. ^{aa} ~~Composition according to one of Claims 1 to 11, characterized in that~~ it comprises, by weight:

- at least 50% and preferably from 65 to 95% of poly(amide) PA,

the remainder to 100% of the poly(caprolactone)-PB-PS triblock copolymer,

these percentages being calculated with respect to the total weight of thermoplastic resin(s) and of the block copolymer.

18. ^{aa} ~~Composition according to one of Claims 1 to 11, characterized in that~~ it comprises, by weight, at least

50% and preferably from 65 to 95% of semi-crystalline thermoplastic fluorinated resin(s) and the remainder (to 100%) by weight of at least one block copolymer with a number-average molecular mass (M_n) of greater than or equal to 20,000 g.mol⁻¹, preferably of between 50,000 and 200,000 g.mol⁻¹, composed of:

- 20 to 93 and advantageously of 30 to 60 parts by weight of A sequences,

- 5 to 50 and advantageously of 10 to 40 parts by weight of B sequences,

- 2 to 50 and advantageously of 5 to 40 parts by weight of C sequences,

the percentages being calculated with respect to the total weight of fluorinated resin(s) with the block copolymer.

19. ⁴¹⁰ Composition according to Claim 18, characterized in that it comprises poly(vinylidene difluoride) (PVDF) as thermoplastic fluorinated resin and a poly(methyl methacrylate)-poly(butadiene)-poly(styrene) triblock copolymer.

20. ⁴¹¹ Composition according to one of Claims 1 to 11, characterized in that it comprises, by weight, at least 50% and preferably from 65 to 95% of semi-crystalline thermoplastic vinyl resin(s) and the remainder (to 100%) by weight of at least one block copolymer with an M_n of greater than or equal to 20,000 g.mol⁻¹, preferably of between 50,000 and 200,000 g.mol⁻¹, composed of:

- 20 to 93 and advantageously of 30 to 60 parts by weight of A sequences,

- 5 to 68 and advantageously of 11 to 55 parts by weight of B sequences,

- 2 to 50 and advantageously of 5 to 49 parts by weight of C sequences,

the percentages being calculated with respect to the total weight of vinyl resin(s) with the block copolymer.

21. ⁴¹² Composition according to Claim 20, characterized in that it comprises poly(vinyl chloride) (PVC) as semi-crystalline thermoplastic vinyl resin and a poly(methyl methacrylate)-poly(butadiene)-poly(styrene) triblock copolymer.

22. ⁴¹² Composition according to Claim 20, characterized in that it comprises chlorinated poly(vinyl chloride) (CPVC) as semi-crystalline thermoplastic vinyl resin and a poly(methyl methacrylate)-poly(butadiene)-poly(styrene) triblock copolymer.

23. ⁴¹³ Composition according to one of Claims 1 to 11, characterized in that it comprises, by weight, at least

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50% and preferably from 65 to 95% of semi-crystalline styrene thermoplastic resin(s) and the remainder (to 100%) by weight of at least one block copolymer with an M_n of greater than or equal to $20,000 \text{ g.mol}^{-1}$,
5 preferably of between $50,000$ and $200,000 \text{ g.mol}^{-1}$, composed of:

- 20 to 93 and advantageously of 30 to 60 parts by weight of A sequences,
 - 5 to 50 and advantageously of 10 to 40 parts
10 by weight of B sequences,
 - 2 to 50 and advantageously of 5 to 40 parts by weight of C sequences,
- the percentages being calculated with respect to the total weight of styrene resin(s) with the block
15 copolymer.

24. ^{am} ~~Composition according to Claim 23, characterized in that it comprises poly(styrene) as semi-crystalline thermoplastic styrene resin and a poly(styrene)-poly(butadiene)-poly(methyl methacrylate) triblock copolymer.~~
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25. ^{am} ~~Composition according to one of Claims 1 to 24, characterized in that it additionally comprises one or more thermoplastic polymer(s) D compatible with the C sequences, D being present in an amount of less than 10% of the total mass of thermoplastic resin(s) X_1 to X_n and of the block copolymer(s) with, possibly, its side products.~~
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26. ^{A process} ~~Process for the preparation of a material or of an item from the composition according to ^{claim} one of claims 1 to 25, characterized in that it comprises the following stages:~~
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- the thermoplastic resin(s) X_1 to X_n is (are) mixed in the molten state with the block copolymer(s) and optionally the thermoplastic polymer(s) D, optionally in the presence of additives and/or of
35 fillers which can remain in a solid state,

- the liquid or the molten material (optionally with the suspended fillers) thus obtained is cooled to give a material or an item in the solid state.

27. ^{A material} ~~Material or item having a composition according to one of Claims 1 to 25, characterized by the following specific heterogeneous structure:~~

- the structure is formed of a continuous phase (matrix) formed essentially of the thermoplastic resin or resins X_1 to X_n comprising a non-continuous phase dispersed in a very even manner as nodules with a size D_n of less than 0.5 micrometre,

- each nodule comprises an internal region composed mainly or essentially of C blocks and an external peripheral region comprising the B blocks of the copolymers with at least three A, B and C blocks connected to one another in this order, this peripheral region surrounding the internal region in a continuous or discontinuous fashion.

28. ^A ~~Material or item according to Claim 27, characterized in that the copolymer with at least three A, B and C blocks comprises, as side products of its synthesis, a B-C diblock copolymer and optionally C homopolymer and that the heterogeneous structure specific to this composition is modified in that the internal region of the nodules, composed mainly or essentially of C blocks, surrounds one or more domains composed essentially of B blocks of the B-C diblock.~~

29. ^A ~~Material or item according to Claim 27 or 28, characterized in that the nodules have a size D_n ranging from 30 to 350 nanometres.~~

30. ^A ~~Material or item according to Claim 27 or 28, characterized in that the nodules have a size D_n ranging from 60 to 250 nanometres.~~

31. ^A ~~Material or item according to one of Claims 27 to 30, characterized in that the distance between two neighbouring nodules D_i is between 1.1 and 5 times the value of the size D_n .~~

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